

A new abyssal genus of the family Ophiuridae (Echinodermata : Ophiuroidea)

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Introduction

A new genus of abyssal ophiuroid from the NE Atlantic belonging to the subfamily Ophiurinae of the family Ophiuridae is described. Its relationship to the genera *Ophiotrochus* and *Bathylepta* is discussed and justification given for the transfer of these two genera from the Ophioleucidae to the Ophiurinae, both of which are rediagnosed. *Uriopha* is the fourth purely abyssal genus belonging to the family Ophiuridae to have been discovered in recent years, *Perlophiura* Belyaev & Litvinova, 1972, *Abyssura* Belyaev & Litvinova, 1976 and *Bathylepta* Belyaev & Litvinova, 1972 are the other three. It is perhaps slightly surprising that a new genus should be found in what could be considered a well investigated region. This might be due to the small size of the specimens resulting in their being overlooked by past researchers. The specimens of *Uriopha* form part of a collection of deep sea ophiuroids made by the Institute of Oceanographic Sciences' *Discovery* Investigations off North West Africa.

Systematic descriptions

URIOPHA gen. nov.

DIAGNOSIS. A genus of the subfamily Ophiurinae, family Ophiuridae, with the disk completely covered by granules obscuring the plates beneath; the disk is convex or even domed; no arm combs or genital papillae are developed; the jaw has a spiniform apical papilla flanked on each side by oral papillae which becomes more blocklike distally; the adoral plates are long and thin; the oral shields are small and triangular; the second oral tentacle pore emerges superficially, away from the mouth slit; the tentacle pores are round, distinct and occur along the whole arm length, each has one large rounded scale and sometimes a smaller indistinct scale underlying it; there are two conical appressed arm spines on each lateral arm plate beyond the disk.

TYPE-SPECIES. *Uriopha ios* sp. nov.

DERIVATION OF NAME. *Uriopha* is an anagram of *Ophiura*, a genus of the Ophiuridae, and *ios* is derived from the initials of the Institute of Oceanographic Sciences.

Uriopha ios sp. nov.

Fig. 1

The eleven individuals of the type series have disk diameters of 3–4 mm. Viewed from above the disk is round to subpentagonal; in side view it appears high and in many specimens domed. A dense coating of granules, each about 0.04 mm in diameter, covers the dorsal surface and ventral interradiial areas, obscuring the plates, including the oral and adoral shields but not the oral plates. The underlying dorsal plates are numerous, small and slightly imbricated, more so in the domed specimens. Except for the centrodorsal plate in some specimens, the primary rosette is usually indistinct. The radial shields are irregular though

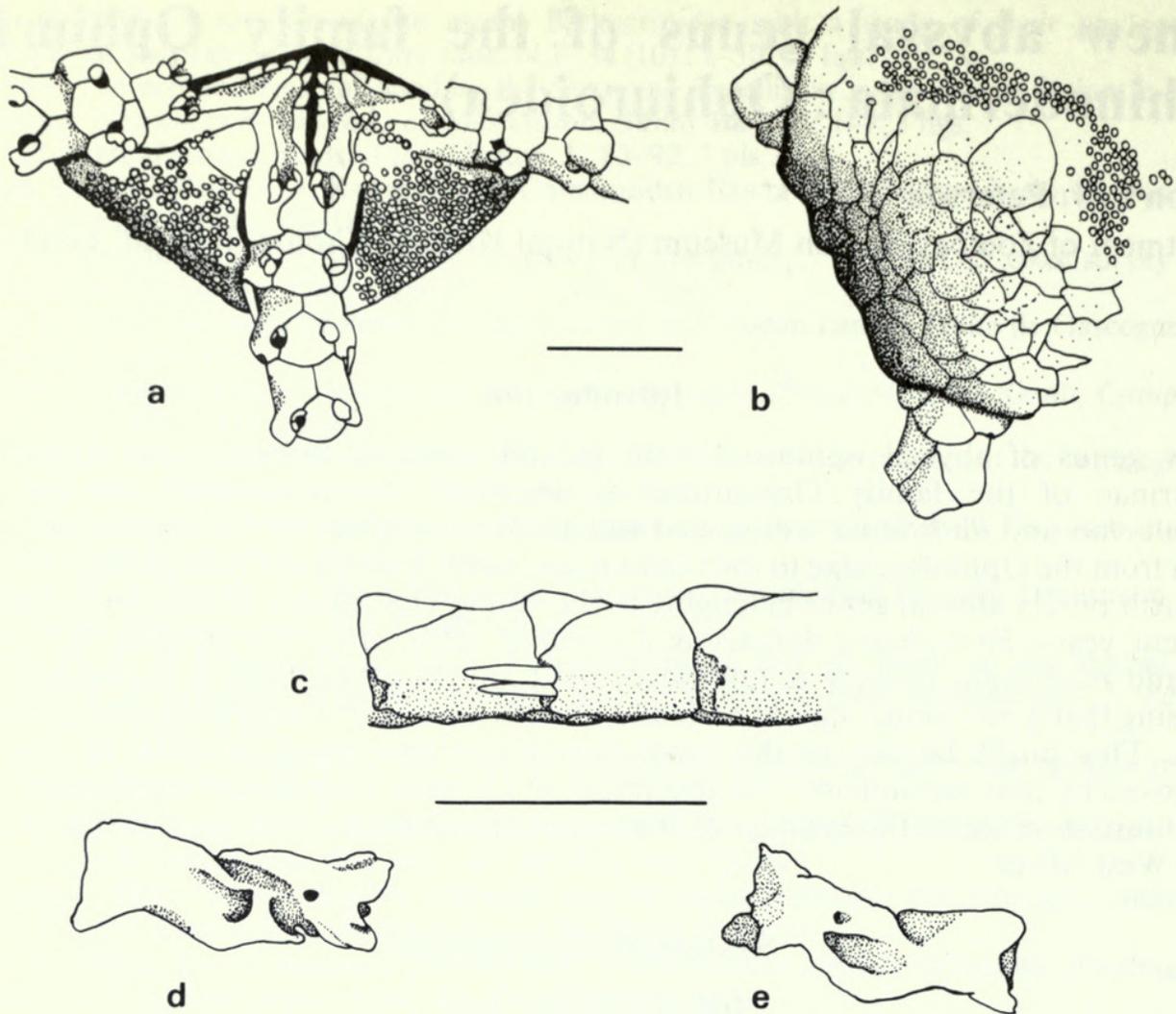


Fig. 1 *Uriopha ios* sp. nov. (a) Holotype, (b–e) Paratypes. (a) Ventral view of part of disk. (b) Dorsal view of part of denuded disk. (c) Lateral view of arm fragment. (d) Adradial and (e) abradial view of oral plate. Bar scales = 1 mm..

approximately rectangular in shape, length: maximum breadth is 1.5–2.0 : 1. They may be wholly contiguous or only distally so. Interradially the radial shields are separated by several plates. Arm combs are absent. Ventral disk scales are slightly larger and not imbricated like those of the dorsal surface.

The apical papilla is spiniform; on each side of it are 3 or 4 oral papillae, broadening progressively from peglike to blocklike. The oral plates are long and rectangular and are raised up in the interradiial midline where they meet. The adoral plates meet on the midline although this suture is partially obscured by the oral shield; they are approximately four times longer than wide, flaring distally where they meet the first lateral arm plates. The oral shield is triangular with a straight distal side; it partially overlies the adorals and is totally proximal to the two genital slits, not spanning them.

The second oral tentacle pore arises superficially and away from the mouth slit and is surrounded on three sides by 4–6 tentacle scales, arising partly from the first ventral arm plate and partly on the bordering edge of the adoral plate. These scales are distinct from and do not form a continuous series with, the mouth papillae; in some cases they may appear continuous but there is a distinct gap between the last oral papilla and the nearest tentacle scale (see Fig. 1a). The genital slits are edged by granules not differentiated from those of the disk.

The fragile arms are almost cylindrical, slightly higher than wide. They are often broken off short. The first dorsal arm plate is overlaid by the disk; it is contiguous with the next plate but subsequent plates are separated becoming progressively smaller down the arm. The first complete dorsal arm plate is trapezoidal with a convex distal edge, subsequent plates are

triangular with a slight convex edge. In side view the dorsal arm plates appear swollen above the lateral arm plates (see Fig. 1c). The two arm spines are conical situated towards the ventral end of the lateral arm plates. The first ventral arm plate is pentagonal sometimes with a cleft or furrow running proximally into the mouth slit. The following plates are pentagonal with the lateral edges indented by the tentacle pores, the distal edge is slightly convex. The tentacle pores are round, distinct and present on all the arm segments. The tentacle pore of the first arm segment has two, sometimes three tentacle scales, the remaining pores have one distinct rounded scale sometimes with one small indistinct scale.

The holotype (fig. 3) has a disk diameter of 3.4 mm. The arms of the holotype and paratypes are all broken but from one specimen which has an almost intact arm, measuring 5.5 mm, it can be estimated that the arms were two to three times the disk diameter. Type locality: Stn 8524 1, *Discovery* Investigations, 20°46'N : 22°42'W (west of Cap Blanc and north of Cape Verde Islands), 4412 m.

DISCUSSION. The superficial position of the second oral tentacle pore prompts inclusion of this genus in the subfamily Ophiurinae, the second subfamily, Ophiolepidinae differs in having this opening within the oral slits. *Uriopha* shows a combination of characters which readily distinguish it from the other genera of the Ophiurinae. Certainly some individual characters unusual in this subfamily, such as the low number of arm spines or the granulation of the disk, are shared by particular genera, suggesting possible relationships, but these are unsupported by the other characters. For example, the genera *Ophiomastus* Lyman, 1878, *Ophiopyrgus* Lyman, 1878 and *Ophiuraster* H. L. Clark, 1939 also have a low number of arm spines, two or less, and a simple form of tentacle scale on the arm pores but they have large thick and sometimes swollen disk and arm plates and in the case of *Ophiomastus* and *Ophiopyrgus* the disk is dominated by the centrodorsal, primary rosette and radial shields. *Uriopha* by contrast has small thin disk and arm plates and the primary rosette is indistinct. The genital slits also differ, being long and well developed in *Uriopha* but short or absent altogether in these three genera, while the shapes of the adoral and oral shields are very different and only *Uriopha* possesses a granulated disk.

However, *Uriopha* does appear to have a genuine affinity with the genus *Ophiotrochus* Lyman, 1878, referred by Matsumoto (1915) to the Ophioleucidae when he differentiated that family from the Ophiuridae (Ophiolepidae in Matsumoto's terminology) (see Fig. 2). Both have a similar arrangement and number of arm spines, with two arm spines set on the ventral end of the lateral arm plate, though *Ophiotrochus* has more than two arm spines on the first arm segments; both have similar tentacle pore and scale form on the free arms, though *Uriopha* has two to three scales on the first arm pore; the genital slits are developed to a similar degree; the adoral and oral shields are of similar shape and arrangement and both have granulated disks though in *Ophiotrochus* this is limited to the ventral side.

This affinity does not imply inclusion of the new genus in the Ophioleucidae since several factors support a proposition that not only *Ophiotrochus* but also *Bathylepta* Belyaev & Litvinova, 1972, should be transferred from the Ophioleucidae to the Ophiurinae. First and most importantly, the second oral tentacle pore arises superficially outside the mouth slit whereas the other ophioleucid genera have the second oral tentacle pore opening entirely within the mouth slits. The alignment of this pore is the primary character of the Ophiurinae and alone warrants their distinction from the Ophioleucidae. Within the order Chilophiurina, comprising the families Ophiidermatidae, Ophionereididae, Ophiocomidae, Ophiuridae and Ophioleucidae, only the Ophiurinae possesses this character. Koehler (1904) first noted its importance and suggested that it might be used to separate groups within the genus *Ophioglypha* (*Ophiura*, *sensu* H. L. Clark, 1911). In his revised classification of the Ophiuroidea, Matsumoto (1915, 1917) regarded the alignment of the second oral pore as an important character at the family-subfamily level. In his parallel keys to the family groups of the Chilophiurina (Matsumoto, 1915, pp. 74-75) this character separates his Ophiomastinae, now Ophiurinae, from all the other family-group units. Although the second oral tentacle of the Ophiurinae emerges ventrally in basically two ways,

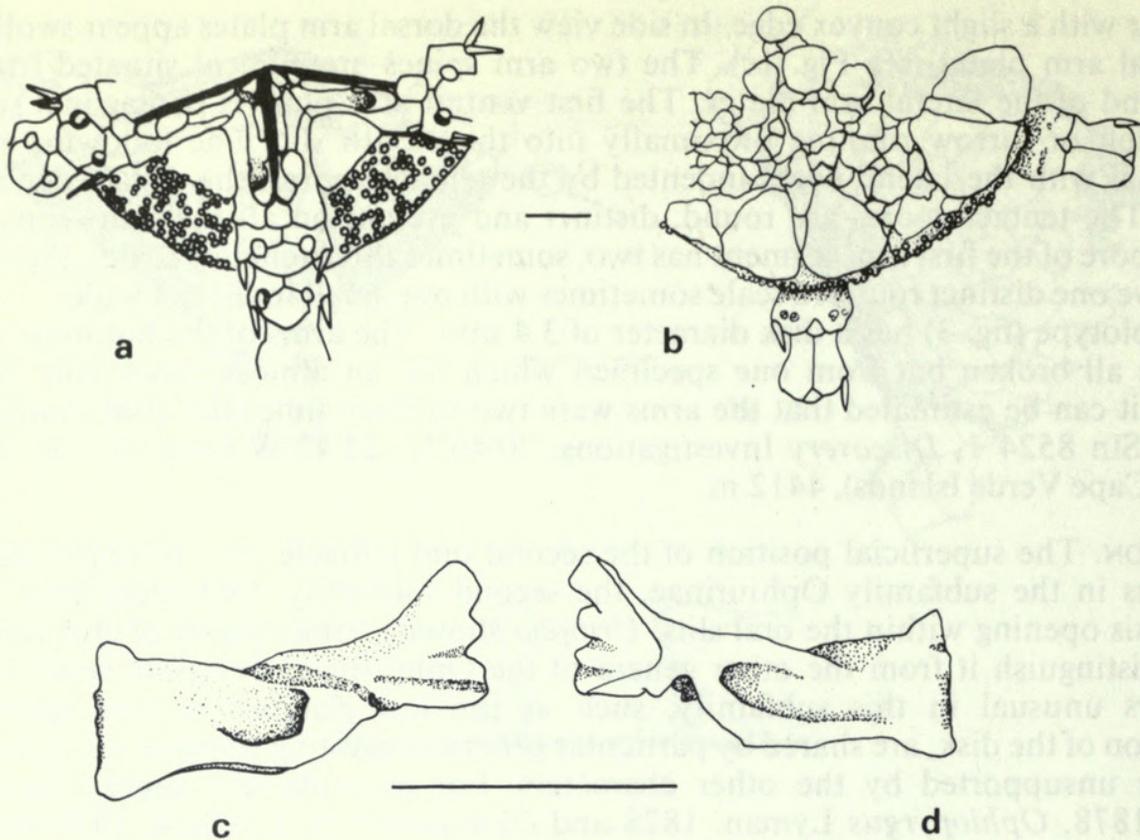


Fig. 2 *Ophiotrochus longispinus* H. L. Clark. (a) Ventral and (b) dorsal view of part of disk. (d) Adradial and (c) abradial view of oral plate. Bar scales = 1 mm.

either opening via a slit or directly on to the ventral surface, both Koehler (1922) and Matsumoto (1915, 1917) consider them to be variations of one character. Such a distinct character suggests that the relationships between the subfamilies Ophiurinae and Ophiolepidinae should be investigated and further study may warrant raising them to family status. In addition *Ophiotrochus* and *Bathylepta* lack the large contiguous successive dorsal and ventral arm plates, the well developed peg-like oral papillae and the long flattened arms characteristic of the Ophioleucidae. These two genera currently form an anomalous group within the Ophioleucidae not closely related to *Ophioleuce* Koehler, 1904 and the other genera included.

One character thought by Fell (1960) and Matsumoto to be important but now set aside is that of the insertion and degree of integration of the arms with the disk. This character seems to be affected by both the extent of the genital slit and the state of preservation of the specimen and may be misleading. Matsumoto (1917) considered *Ophiotrochus* to be a neotenous ophioleucid probably because of the ventral insertion of the arms even though he noted that the second oral tentacle pore emerges superficially, unlike that of the other genera of the Ophioleucidae.

Bathylepta is related to both *Uriopha* and *Ophiotrochus* by the reduced number of arm spines and the development and shape of the adoral and oral shields. It differs mainly in the juvenile form of the oral papillae, which could be interpreted as a neotenous condition, the absence of genital slits and of tentacle scales except on the second oral tentacle pore (see Belyaev & Litvinova, 1972; Madsen, 1977).

Due mainly to the work of Schoener (1967, 1969) on post larval development of several species of deep water ophiuroids, we are better able to recognize neotenous characters prolonged from early ontogenetic stages. Her observations indicate that such features as the lack of tentacle scales, the rudimentary form of the oral papillae and the lack of genital slits in *Bathylepta*; the fused oral papillae in *Ophiotrochus* and the small non-contiguous dorsal arm plates in *Bathylepta* and *Uriopha* and probably their absence in *Ophiotrochus*, are all characters found in the early stages of most species. As ontogeny progresses the tentacle scales appear. Also the superficial adradial edge of the oral plate differentiates into a

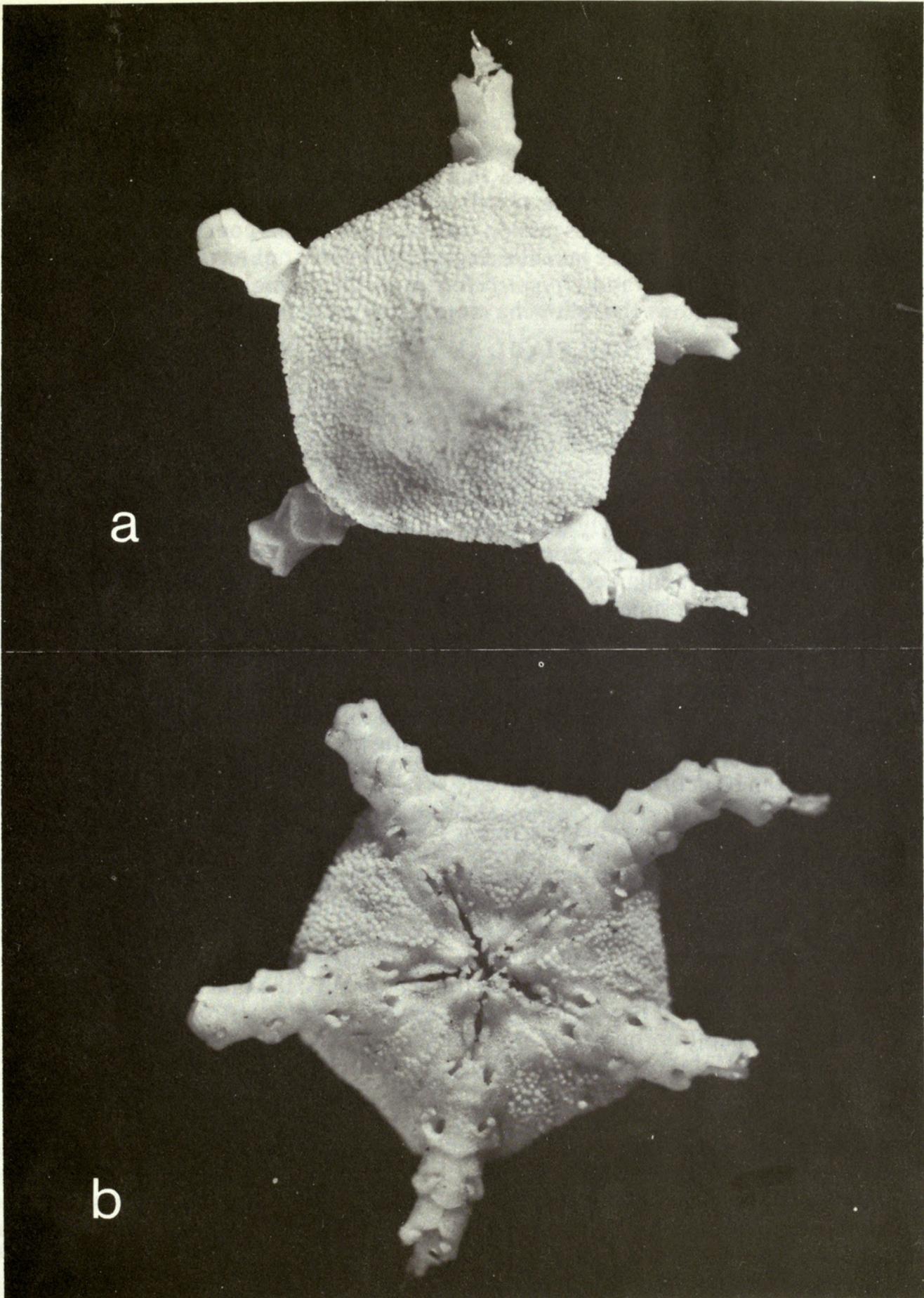


Fig. 3 *Uriopha ios* sp. nov. (a) Dorsal and (b) ventral view of holotype.

flange which subsequently enlarges and becomes indented to form individual oral papillae. Further development varies with the species, in some, such as *Ophiura ljungmani*, the papillae separate from one another and become peglike, whereas in *Ophiomusium lymani* they remain contiguous and block-like. As the dorsal arm plates enlarge, in many cases they become contiguous while in others they remain small and separate. By a disk diameter of c. 2–3 mm the adult features are recognisable and further growth involves only minor changes in proportions. Schoener showed that in *Ophiura sarsi* the juvenile stages up to 0.9 mm disk diameter have only two arm spines, rather than the adult three, suggesting that this character in the genera under discussion may be a neotenuous condition; however, I have been unable to confirm this for the juvenile stages of any other ophiuroid species.

The removal of *Bathylepta* and *Ophiotrochus* from the Ophioleucidae leaves the family more homogenous and allows the following more restricted definition:

OPHIOLEUCIDAE Matsumoto, 1915

A family of the Chilophiurina with the disk comprised of scales completely or partially covered by a coat of granules sometimes also covering the radial shields, adoral and oral shields; the adoral shields are usually long and flared distally; the oral shields are small, triangular or arrow shaped; the teeth are papilliform and arranged in a single series; the second oral tentacle pores open within the mouth and are not visible externally; the arms are long, flat and wide and taper slowly to the end of the arm; the dorsal and ventral arm plates are large and successive ones are contiguous, at least proximally; the tentacle pores are variable in size, sometimes enlarged but becoming smaller distally, armed with one to several scales; the disk may appear superficial, overlying the arm bases.

The family as restricted includes the genera *Ophioleuce*, Koehler 1904, *Ophiernus* Lyman 1878, *Ophiocirce* Koehler, 1904, *Ophiopyren* Lyman 1878 and *Ophiopallas* Koehler 1904 (*Ophioperla* Koehler, 1912 was inexplicably and erroneously referred to the Ophioleucidae from the Ophiuridae by Fell, 1960 and followed by Spencer & Wright, 1966. Later Fell, 1961, moved *Ophioperla* back to the Ophiurinae).

The Ophiurinae can be defined as follows:

OPHIURINAE Lyman, 1865

A subfamily of the Chilophiurina with a disk covered by scales, which are usually distinct but may be obscured by a covering of opaque skin or granules; the primary rosette is often conspicuous, sometimes dominating the disk; the radial shields are usually conspicuous; opposite each arm base a comb of papillae or spinelets is often present and may be continuous ventrally with papillae bordering the genital slits; the oral and adoral shields are variously developed (though ill-defined in the specialized genus *Astrophiuira*); the teeth are narrow, pointed or papilliform; at the apex of the jaw no tooth papillae are present but usually a single infradental papilla bordered on each side by a continuous series of pointed, rounded or blocklike papillae; the second oral tentacle pore opens either directly or via a slit onto the ventral surface; the arms are of moderate or short length, widest proximally, tapering, flat or cylindrical, usually not moniliform, the exceptions being *Ophiotrochus* and *Perlophiura* which possess moniliform arms; the lateral arm plates are very evident, the dorsal and ventral arm plates being usually small so that successive ones are contiguous only on the basal segments, in some cases the dorsal arm plates may be undeveloped altogether as in *Anthophiura* and *Ophiotrochus*; the arm spines are mostly small and appressed; the tentacle pores are of varying sizes and may be found throughout the arm length or only proximally, usually armed with rounded or spine-like scales, which are absent in *Haplophiura*, the tentacle scales are variable in number and arrangement; the disk may appear to surround the arm bases.

The genera belonging to this subfamily are as listed by Fell (1960) with the following additions: *Anophiura* H. L. Clark, 1939, *Ophioperla*, *Perlophiura*, *Abyssura*, *Ophiotrochus*, *Bathylepta*, and *Uriopha*.

Uriopha, *Ophiotrochus* and *Bathylepta* are compared and contrasted in table 1. While these three genera form a distinct closely-related group within the Ophiurinae, further study is needed before their relationships to the remaining genera in this subfamily can be clarified.

Table 1 Comparing the genera *Bathylepta*, *Ophiotrochus* & *Uriopha*.

Character	<i>Bathylepta</i>	<i>Ophiotrochus</i> (see fig. 2a-d)	<i>Uriopha</i> (see fig. 1a-e)
Area of granulation on disk	Total	Ventral only	Total
Arm spine number	2	4 on first arm joint past the disk then 2	2
Adoral shields	Well developed	Well developed	Well developed
Oral shield	Small triangular	Small triangular	Small triangular
Genital slits	Absent	Present	Present
Dorsal armplate	Present, triangular	Absent	Present, triangular
Radial shields	Long thin not contiguous	Wider than long contiguous or distally so	Wider than long contiguous or distally so
Oral papillae	Very neotenous	Wide, blocklike, fused	Peglike becoming block-like distally
2nd oral tentacle pore	With 2 small scales	With one large fused opercular plate	With 4-6 scales
Tentacle scales of arms	Absent	One large round scale	One large round scale

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